

It therefore is requested that the restriction requirement be reconsidered, and that claim 43 be retained in consolidation form for further examination and prosecution on the merits.

If the restriction requirement nonetheless is made final, applicants alternatively request rejoinder of method claim 43 under the provisions of M.P.E.P. §821.04 upon confirmation of allowable subject matter of the Group I claims 1, 4-7, 9, 11-14, 41 and 42.

Towards that end, Applicants also respectfully request, as a reminder, rejoinder of method claims 17, 20-25, 27, 29-31, 33 and 35-38 upon allowance of the composition claims 1, 4-7, 9, 11-14, and 42.<sup>1</sup> Towards that end, withdrawn method claims 17 and 29 have been amended in a manner consistent with the pending composition claims.

#### **Rejection of Claims Under 35 U.S.C. §102**

The Examiner has rejected claims 1, 4, 5, 7, 9, 14, 41 and 42 under 35 U.S.C. §102(e) as being anticipated by Sehgal (US 2004/0050406) (hereinafter Sehgal).

Applicants have amended claim 1 to recite the limitations of previously pending claim 39, which was impliedly novel in view of Sehgal, thereby obviating this rejection. Withdrawal of same is respectfully requested.

#### **Rejections under 35 U.S.C. §103(a)**

1. In the January 4, 2007 Office Action, claims 39 and 40 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal. Applicants traverse such rejection.

Sehgal relates to the removal of photoresist and/or resist residue from a substrate and discloses a "co-solvent 1" mixture which includes one or more organic solvent(s) and may further include any one of an oxidizer, buffering agents, corrosion inhibitors, chelating agents, surfactants,

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<sup>1</sup> Rejoinder was previously requested in the response to the June 9, 2005 Office Action, filed June 15, 2005, and the response to the August 24, 2005 Office Action, filed November 23, 2005.

accelerators, or aqueous fluorides. The disclosed embodiments include:

- embodiment 1: a carbonate, DMSO and hydrogen peroxide;
- embodiment 2: a carbonate, benzyl alcohol, and hydrogen peroxide;
- embodiment 3: a carbonate, DMSO, hydrogen peroxide, and ammonium fluoride;
- embodiment 4: addition of an accelerator to each of the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> embodiments;
- embodiment 5: a carbonate, benzyl alcohol, formic acid and an accelerator;
- embodiment 6: a carbonate, benzyl alcohol, hydroxyl propyl carbamate and hydrogen peroxide;
- embodiment 7: a carbonate, benzyl alcohol, trioxane and hydrogen peroxide.

According to the Examiner, Sehgal

“differs in failing to teach the composition “consisting essentially of” or “consisting of” Applicant’s specifically claimed supercritical fluid, at least one co-solvent, and at least one bifluoride compound, as recited in the claims. However, Sehgal illustrates the combination of a supercritical fluid and at least one co-solvent, and an aqueous fluoride, which includes ammonium bifluoride may be added to the co-solvent mixture [0048] or other ingredients in supercritical form may be used alone or in combination with each other or with supercritical CO<sub>2</sub> [0025]. Hence, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Sehgal by using any combination of components, including Applicants’ specifically claimed composition because such components are known to effect the disclosed composition in processing semiconductor substrate since Applicants have failed to provide evidence as to what is actually excluded by “consisting essentially of.” (emphasis added)

Applicants vigorously disagree.

As introduced hereinabove, Sehgal relates to the removal of photoresist and/or resist residue. As such, one skilled in the art considering Sehgal and assigned with the task of removing sacrificial silicon-containing materials from a substrate would have absolutely no direction as to which of the seven optional genus’s in Sehgal should be added to the organic co-solvent to effectuate the removal of sacrificial silicon-containing material (while not removing polysilicon material (see,

e.g., the presently pending application, Figures 2 and 4)), much less select the JUST the bifluoride species from the fluoride source genus.

Further, in Example 8 Sehgal recites:

"[0096] The substrate used in the eighth example included a via structure which contained a low k dielectric layer. Prior to the experiment, photoresist was removed using an asher, leaving post-ash residues in the via structure. The specific chemistry employed was the following: 39.93% (by weight) 1,2-Butylene Carbonate, 39.93% Dimethyl Sulfoxide, and 29.94% of 30% hydrogen peroxide and 0.2% of 40% ammonium fluoride. [] The co-solvent 1 mixture was carried into the process chamber by supercritical carbon dioxide at a flow rate of 72 g/min to have a total fluid flow rate into the process chamber at 80 g/min. []

[0097] A 5-minute exposure of the post ash residues to the co-solvent 1 mixture was found to have completely dissolved and removed the post ash by SEM analysis. SEM photo of various die locations showed that complete residue removal was achieved with no attack of the semiconductor structure geometries." (emphasis added)

It is well known in the art that low-k dielectric materials are typically silicon-containing materials. As such, one skilled in the art considering Sehgal and assigned with the task of removing sacrificial silicon-containing materials would read Example 8 and would reasonably NOT consider adding a fluoride source, much less the bifluoride species, to the composition because the Example 8 composition including a fluoride source did not attack the semiconductor structure geometries, which include low-k dielectric material.

As recited in the court in *Medichem, S.A., v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006):

"to have a reasonable expectation of success, one must be motivated to do more than merely vary all parameters or to try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful."

In the present case, Sehgal does not relate to the removal of sacrificial silicon-containing

material. As such, there is no direction as to which of the seven different genus's, much less the species within a genus, to select to successfully remove sacrificial silicon-containing material. Otherwise, one skilled in the art will be left with varying all of the parameters until one arrived at a successful result, which does not amount to a reasonable expectation of success. *Id.* Considering Sehgal, there is the possibility of adding one or more of seven possible genus's to the organic solvent. Should one skilled in the art assigned with the task of removing sacrificial silicon-containing materials from a substrate add a component from one, two, three, four, five, six or all seven of the genus's disclosed in Sehgal? If two genus's are appropriate, which two? If three genus's are appropriate, which three? And so on. This is not a simple case where there are a finite number of identified, predictable solutions (*see, e.g., KSR International Co. v. Teleflex Inc.*, No. 04-1350 (slip op., April 30, 2007)).

It is also noted that the Examiner stated that:

“it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Sehgal by using any combination of components . . . because such components are known to effect the disclosed composition in processing semiconductor substrate” (emphasis added)

Is the Examiner contending that one skilled in the art can throw any combination of the components taught in Sehgal in a pot and the mixture will successfully process the semiconductor substrate, regardless of what is to be maintained and removed? Clearly, this is unreasonable. The question should be, is it obvious to use just the organic solvent and the fluoride source and not any of the other components? If the Examiner feels that it is, then the Examiner must provide “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Id.*

Accordingly, applicants request withdrawal of the rejection of claims 39 (now claim 1) and 40 as being obvious in view of Sehgal.

2. In the January 4, 2007 Office Action, claim 6 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal as applied to claim 1, in view of Mullee (US 6,306,564) (hereinafter Mullee). Applicants traverse such rejection.

Claim 6 depends directly from claim 1, which as discussed hereinabove, is non-obvious in view of Sehgal. Mullee does not cure this deficiency.

Similar to Sehgal, Mullee discloses a laundry list of chemical compounds that may be added to the supercritical CO<sub>2</sub> composition of Mullee, including:

“N-Methyl Pyrrolidone (NMP), diglycol amine, hydroxyl amine, tertiary amines, catechol, ammonium fluoride, ammonium bifluoride, methylacetoacetamide, ozone, propylene glycol monoethyl ether acetate, acetylacetone, dibasic esters, ethyl lactate, CHF<sub>3</sub>, BF<sub>3</sub>, other fluorine containing chemicals, or a mixture of any of the above chemicals. [] Other chemicals such as an organic solvent may be used independently or added to one or more of the above chemicals to remove organic contaminants from the wafer surface. The organic solvent may include, for example, an alcohol, ether, and/or glycol, such as acetone, diacetone alcohol, dimethyl sulfoxide (DMSO), ethylene glycol, methanol, ethanol, propanol, or isopropanol (IPA).” (see, Mullee, col. 4, lines 12-36)

Again, it is unreasonable to conclude that one skilled in the art considering Sehgal in view of Mullee would cherry pick the isopropanol organic solvent taught in Mullee and incorporate it into the teaching of Sehgal. This is especially true knowing that the alcohol organic solvents disclosed in Sehgal are all higher order alcohols (“benzyl alcohol, diacetone alcohol, furfuryl alcohol, hexylene glycol, methylbenzyl alcohol . . . phenoxy ethanol, phenoxy propanol, propargyl alcohol, tetrahydrofurfuryl alcohol and the like” (see, Sehgal, paragraph [0029])).

Withdrawal of the rejection of claim 6 as being obvious in view of Sehgal and Mullee is respectfully requested.

3. In the January 4, 2007 Office Action, claims 11-13 are rejected under 35 U.S.C. §103(a) as being unpatentable over Sehgal, in view of Wilkinson et al. (US 5,789,505) (hereinafter Wilkinson). Applicants traverse such rejection.

Claims 11-13 directly or indirectly depend from claim 1, which as discussed hereinabove, is non-obvious in view of Sehgal. Wilkinson does not cure this deficiency.

Wilkinson relates to the use of surfactants in applications using liquid/supercritical CO<sub>2</sub>. In short, Wilkinson discloses a family of surfactants which have been identified as soluble in liquid/supercritical CO<sub>2</sub> and have surface active properties. In short, the combination of Sehgal and Wilkinson does not make obvious applicants' claimed invention consisting essentially of at least one co-solvent and at least one bifluoride species.

Accordingly, applicants respectfully request withdrawal of the rejection of claims 11-13 under §103 in view of Sehgal and Wilkinson.

**Petition for Extension of Time/Fees Payable**

Applicants hereby petition for a one (1) month extension of time, extending the deadline for responding to the January 4, 2007 Office Action from April 4, 2007 to May 4, 2007. The fee of \$120.00 specified in 37 CFR §1.17(a)(1) for such one (1) month extension is hereby enclosed.

The total fee of \$120.00 is being paid by Electronic Funds Transfer. Authorization is hereby given to charge any deficiency in applicable fees for this response to Deposit Account No. 13-4365 of Moore & Van Allen PLLC.

**Conclusion**

Based on the foregoing, claims 1, 4-7, 9, 11-14, and 39-42 are in form and condition for allowance. If any additional issues remain, the Examiner is requested to contact the undersigned attorney at (919) 286-8000 to discuss same.

Respectfully submitted

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